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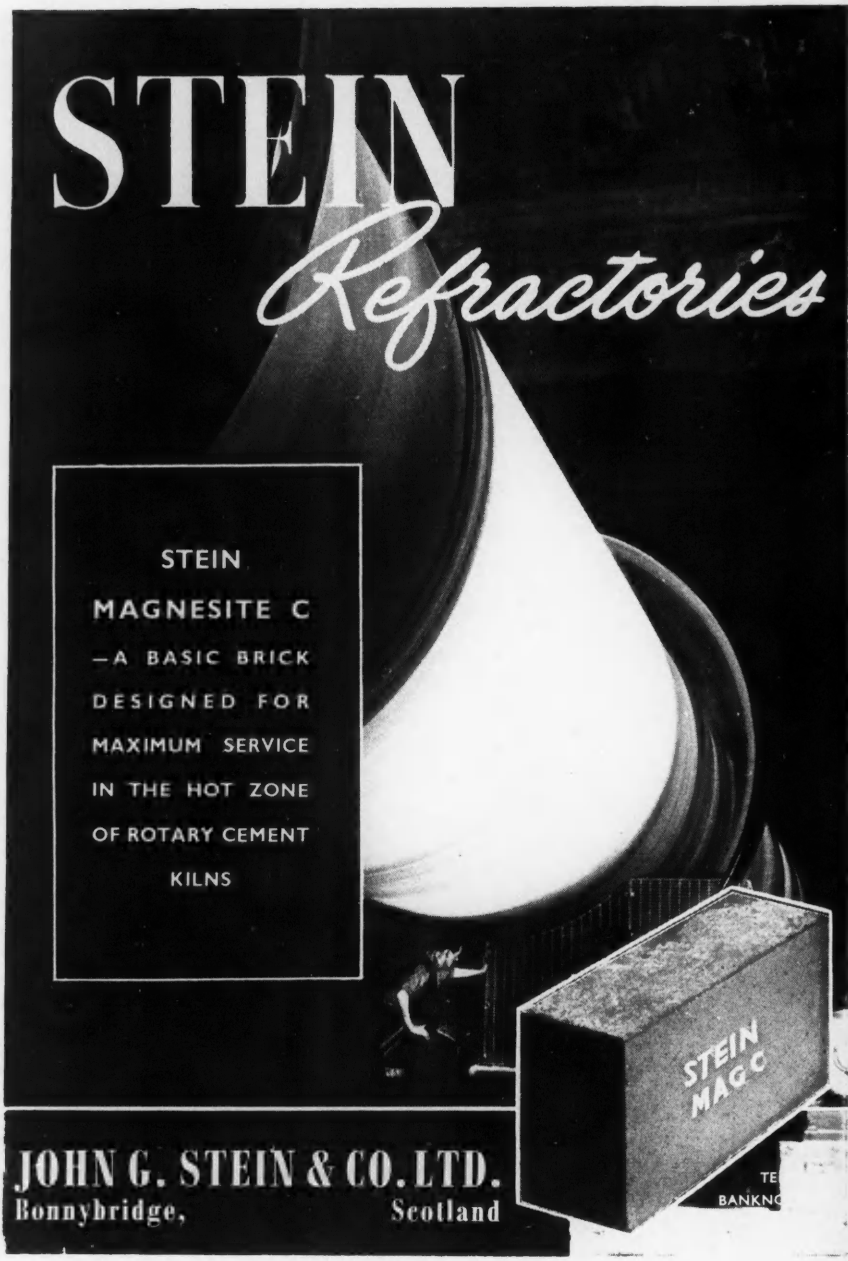
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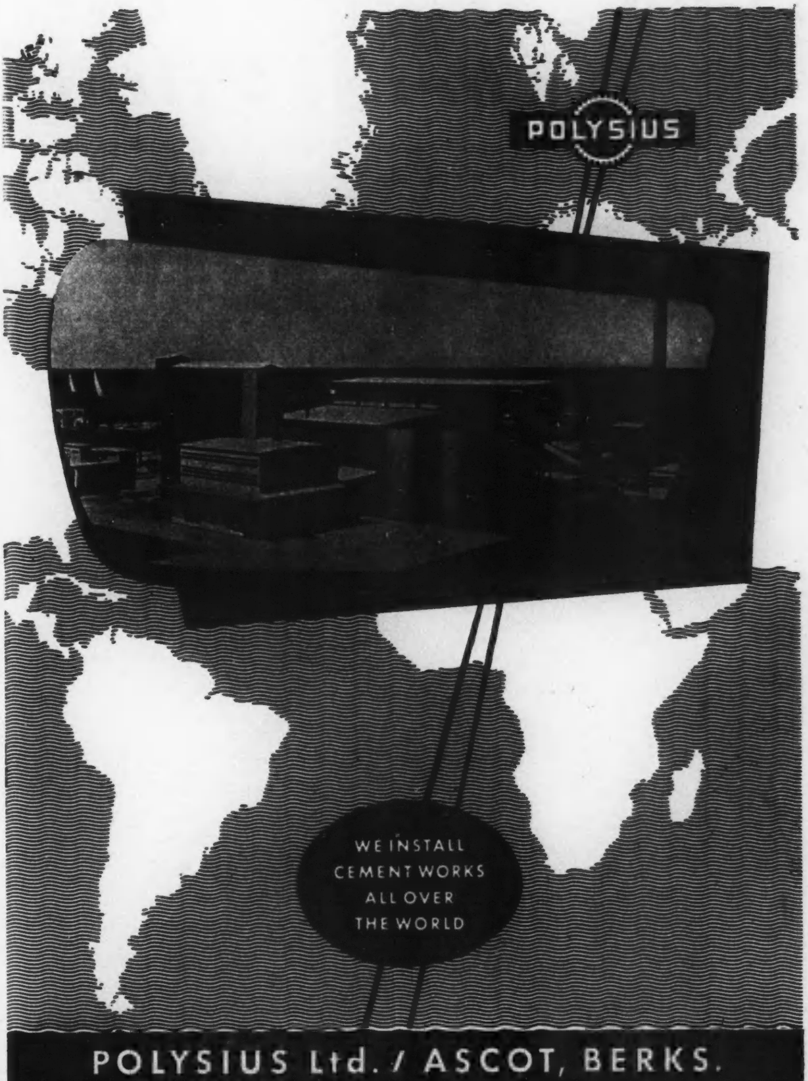
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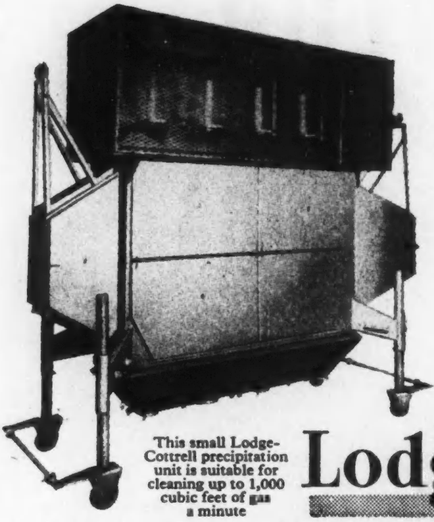

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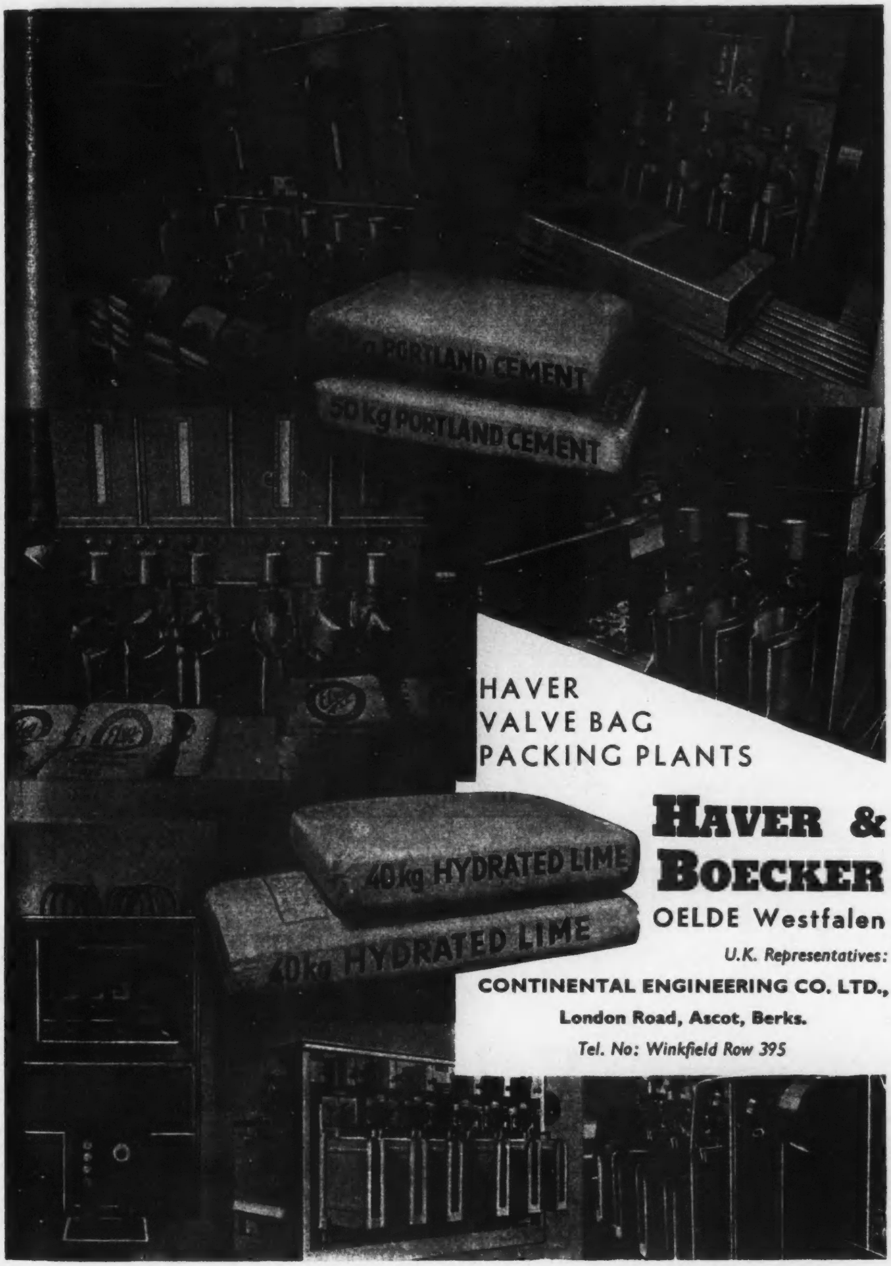
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Improvements at an American Dry-process Works.

THE daily capacity of the dry-process plant at the works of the Ideal Cement Co., at Boettcher, Colorado, U.S.A., has been increased from 600 tons to 1,170 tons, while the power consumption has been reduced from 7,800,000 B.t.u. to 4,800,000 B.t.u. per ton. The improvement has been achieved by the installation of a pre-heater for each of the two original kilns, a new system of storing and blending materials for the kilns, and a system of remote automatic control of the grinding and blending of the raw materials and grinding of the clinker.

Crushing Raw Material.

The original works was built in 1928 and the raw materials were delivered by rail. Four 22-tons diesel lorries now carry the limestone about a mile from the quarry to the works. The limestone is passed through the original 3-ft. by 5-ft. roller-crusher and the secondary crusher, which is a hammer-mill, and is reduced in size to 2 in. This material is stored in eight concrete silos each 25 ft. in diameter, 63 ft. high and of 1,200-tons capacity. Sandstone is crushed in the same way and stored in three 300-tons bunkers. The crushing plant has a capacity of 350 tons per hour.

The limestone and sand are transferred from the stores to the two original oil-fired rotary dryers, which are each 70 ft. long and 7 ft. 6 in. in diameter, and thence by bucket elevator to two single-deck vibrating screens each 5 ft. wide and 14 ft. long. Material less than ⅝ in. in size passes through the screens and is suitable for the raw-grinding mill. A new reversible hammer-mill receives the material retained on the screens. This system has a capacity of about 210 tons per hour.

At this stage the crushed raw material is stored in six concrete silos each 28 ft. 8 in. in diameter, 55 ft. 6 in. high and having a capacity of 1,800 tons. Two other bins are provided, one for sandstone and one for iron-ore, which are delivered to the works in lorries. The silos and bins are in two rows with a 24-in. screw conveyor feeding each row of three silos and one bin. Two silos in each row are for material rich in lime and one for material containing little lime. A 24-in.

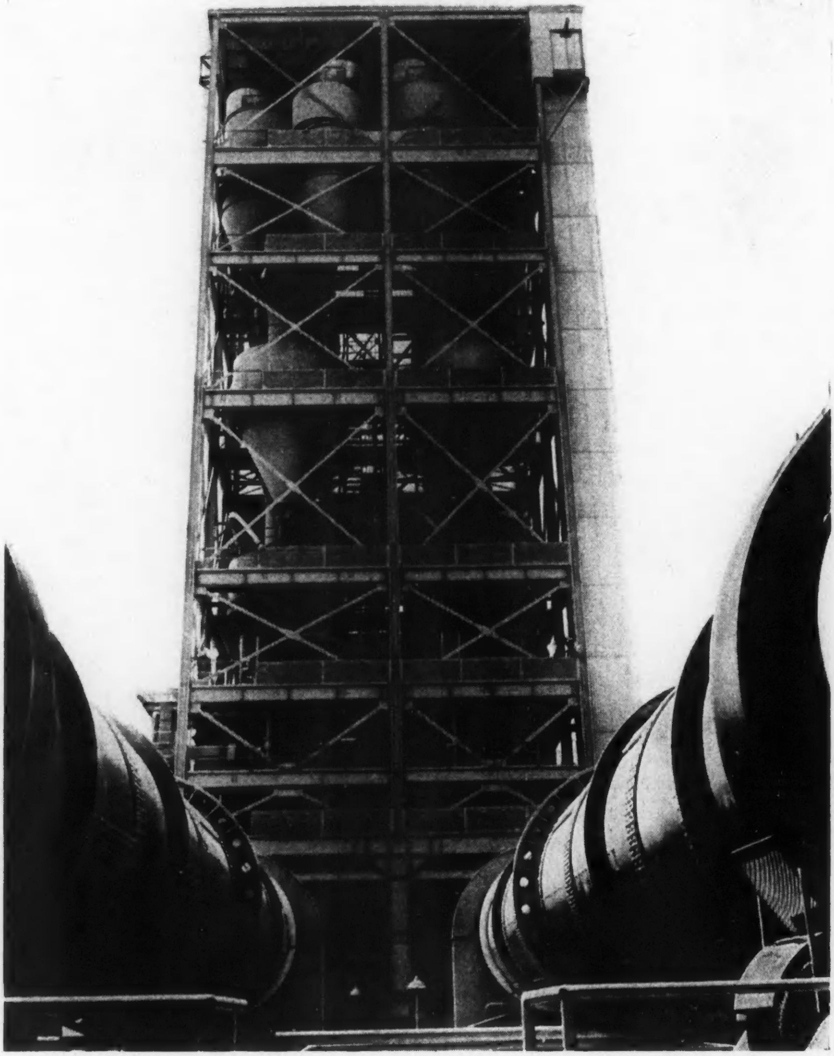


Fig. 1.—The Two Kilns and Preheaters.

feeder under each silo withdraws rock which is proportioned before going to the mills. Sandstone and iron-ore are added as required by means of 16-in. feeders under each bin.

Grinding Raw Material.

Crushed material is delivered by bucket-elevator from storage to each of two new raw-grinding mills which were of the largest capacity available at the time of construction, each being 11 ft. by 23 ft. and each having two compartments; each mill contains 36 tons of 3-in. and 4-in. steel balls in the primary compartment and 83 tons of 2-in. balls in the secondary compartment. Each mill is driven at 17·45 r.p.m. by a synchronous electric motor of 1,500 h.p. The compartments of each mill can be raised from the bronze bearings by high-pressure jacks and each bearing is automatically lubricated.

The crushed material passes over two separators through which dust and fine particles pass to a conveyor supplying the blending silos. Larger material, which is retained by the separator, goes to the grinding mills. The product from the mills

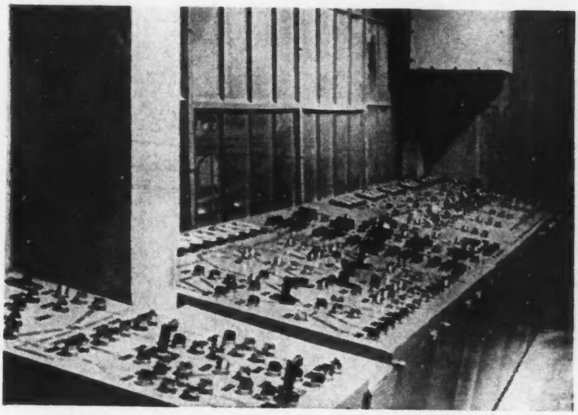


Fig. 2.—Control Console for Raw-material Blending and other Plant.

is returned to the separators thereby forming a closed circuit so that all material leaving the mill has passed through the separators and is of such a size that 85 per cent. passes through a 200-mesh screen. Each mill is vented through a dust-collector having a capacity of 1,100 cu. ft. per minute.

Blending.

The ground material is transferred by two 24-in. screw-conveyors to four blending silos each 40 ft. in diameter, about 56 ft. high, and having a capacity of 2,200 tons. One of these silos is charged with 1,500 tons of material during ten hours, meanwhile another silo is being emptied and the other two hold material ready for the kiln. Samples of the supply to the silos are taken at hourly intervals and analysed to determine the content of $CaCO_3$. From the results the supply to the grinding mill is adjusted as required. The material in the silos is blended for two to four hours and analysed before being released for supply to the kilns. Each silo is equipped with a rotary air-compressor to keep the material in sus-

pension. Each of these compressors is supplemented, while blending takes place, by one of two larger compressors; thus only two silos can be used for blending at one time.

The console for the remote control of the raw-material grinding and blending plant is shown in *Fig.* 2.

Preheating.

Either of two pumps can be used to transfer material from any blending silo, through a dust-collecting system, to four 1,200-ton tanks for supply to the preheaters. The preheaters are supplied at a fixed rate by a system of conveyors and by constant-head feeders from which the material is pumped to the preheaters.

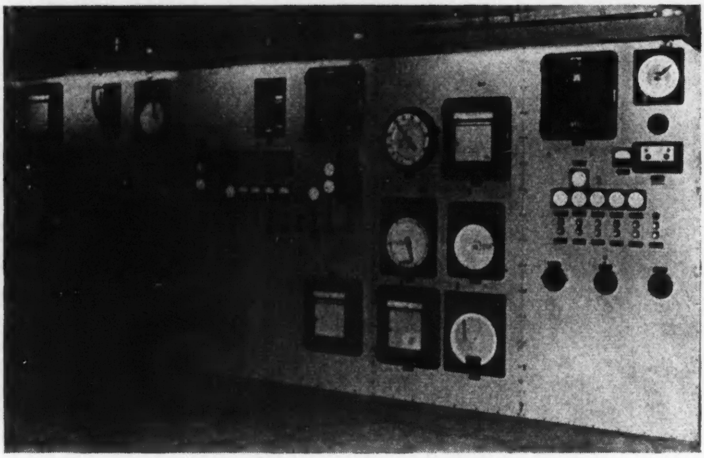


Fig. 3.—Control Board for one of the Kilns.

The preheaters which are of the Fuller-Humboldt type, are supported in a structure 190 ft. high (*Fig.* 1) and receive all the hot gases from the kilns although a by-pass is provided for emergencies. Each preheater has four stages and provision is made for the entry of material after each stage or directly to the kiln. In each preheater there are two cyclones of 10 ft. 9 in. diameter in the first stage, one of 14 ft. 6 in. diameter in the second stage, one of 16 ft. 9 in. diameter in the third stage, and one of 17 ft. 10 in. diameter in the fourth stage. The ducts between the stages are 6 ft. 10 in. in diameter except in the fourth stage where they are 7 ft. 4½ in. in diameter.

At present, blended material enters each preheater between stages No. 1 and No. 2 and hot gases at about 800 deg. F. carry the material up to stage No. 1. The fine particles escaping from the top of stage No. 1 are trapped by a series of eight small cyclones or an electrostatic precipitator and passed to the kiln. The major portion of the blended material passes through the last three stages of

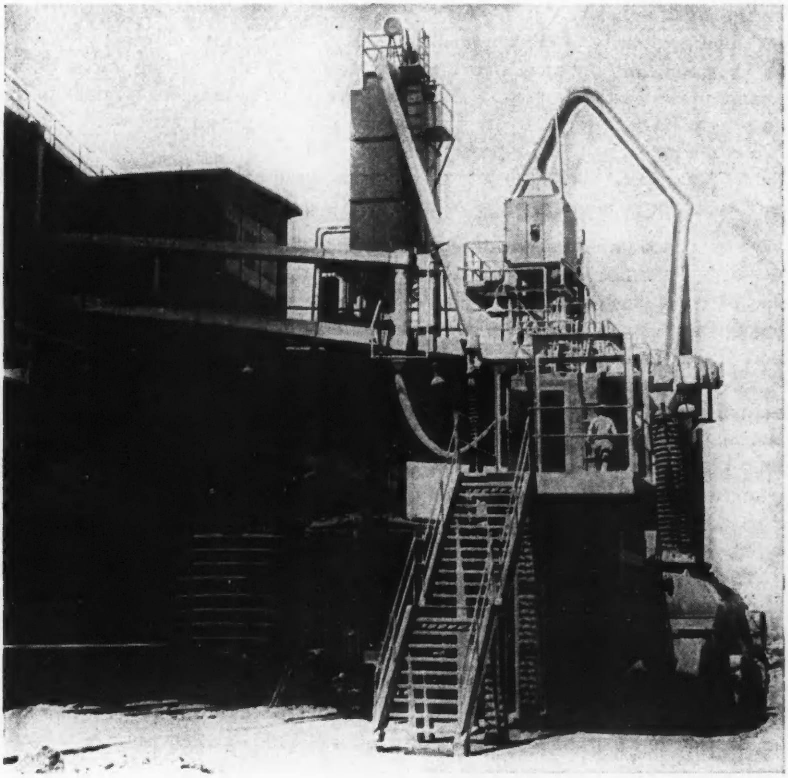


Fig. 4.—Loading Loose Cement.

the preheater, where the highest temperature is about 1,550 deg. F., to the kilns. The pipes from the preheaters to the kilns are 14 in. in diameter and are of spun cast stainless steel. As it enters the kilns the temperature of the material is about 1,450 deg. F.

Kilns.

The two rotary kilns (*Fig.* 1) are 11 ft. in diameter, 175 ft. long and slope ½ in. to the foot. They are driven at 70 r.p.h. by 100-h.p. motors. The firing zones, at which the temperature is about 2,700 deg. F., are lined with 70 per cent. alumina lining. Natural gas is normally burnt although coal can be used if necessary. Each kiln is controlled from a panel (*Fig.* 3). on which are all the instruments and equipment necessary to control the preheater, kiln, cooler and coal mill.

Cooling.

The clinker is discharged to two new air-quenching coolers with reciprocating grates each 4 ft. 6 in. wide and 90 ft. long. Each has a pulsating damper, a

cooling fan of 125,000 cu. ft. per minute capacity, an exhaust fan of 150,000 cu. ft. per minute capacity, a clinker breaker, and a cyclone dust collector.

The gases from the preheaters are cooled in two of three cooling towers before passing to the dust collectors. The third tower is for gases going straight to the chimney. Each tower is 10 ft. 3 in. square and is supplied with water for the sprays at a pressure of 350 lb. per square inch. A fan having a capacity of 275,000-cu. ft. per minute blows the kiln-gases through the 250-ft. chimney which is of reinforced concrete and has a separate brick lining of 14 ft. internal diameter.

Grinding, Storing, and Packing.

Clinker is taken by conveyor, from the coolers, either to three new concrete silos of 1,500 tons capacity, or directly to the finishing mill. Gypsum, which is brought to the works by lorry, is crushed by a 24-in. by 40-in. roller-crusher and stored in a fourth silo. The clinker and gypsum are conveyed to temporary storage bins and thence to five 8-ft. by 26-ft. ball-mills which each have two compartments. The products of these mills are conveyed to a 14-ft. separator and material passing through the separator is taken by air-slide to a surge-bin from which it is pumped by an 8-in. or a 9-in. pump to storage silos. Material retained by the separator is returned to the mills for re-grinding. Dust collected from the separator is returned to the conveyor supplying the separator.

The twelve existing silos for storing finished cement are in two rows and are 30 ft. in diameter and 80 ft. high with a total capacity of 28,500 tons. The fifteen new silos are in three rows and are 26 ft. in diameter and 93 ft. high, having a total capacity of 26,500 tons. Withdrawal from all the silos is by rotary feeders and screw-conveyors.

There are two stations for loading lorries with loose cement (*Fig.* 4), and four four-tube packing machines in the packing building. A control panel is provided for the cement silos and packing department with an indicating panel in the foreman's office.

The improvements of the works were designed by the staff of the Ideal Cement Co., and the construction was by Stearns-Roger Manufacturing Co. The new silos were constructed by D. J. Rheiner and E. H. Conrad Joint Venture of San Antonio, Texas. The foregoing information is abstracted from " Pit and Quarry," June 1959.

Toxic Substances in Factories.

MEASURES for the protection of workers against the inhalation of dusts, fumes, or other impurities, which are likely to be injurious, are discussed in a booklet entitled " Toxic Substances in Factory Atmospheres," which was published recently by the Ministry of Labour. (Safety Health and Welfare Booklets. New Series No. 8. 1960. H.M.S.O. Price 1s.) The greatest permissible concentrations of many substances encountered in industry are given. As regards Portland cement, the limiting number of particles is stated to be 1766 per cubic centimetre.

The Action of Carbon Dioxide on Cement Mortar.

TESTS carried out to investigate the way in which carbon-dioxide gas reacts with hardened Portland cement in mortar are described in the Journal of the American Concrete Institute for December, 1959, by Mr. B. Kroone and Mr. F. A. Blakey of the Commonwealth Scientific and Industrial Research Organisation of Australia. (The effect of carbon dioxide on Portland cement before hydration was the subject of an article in this journal for January, 1959.)

The influence of such factors as evaporable and non-evaporable water on the reaction, and the effect of different storage conditions on the shrinking and strength of the mortar are considered. The absorption of carbon dioxide is found to increase in the presence of evaporable water, and the carbon dioxide absorbed in this manner reacts with the lime compounds. Some results of the tests are given in the following.

The problem of how the CO_2 was bound was raised in earlier tests and X-ray photographs showed the presence of large amounts of calcium carbonate. It

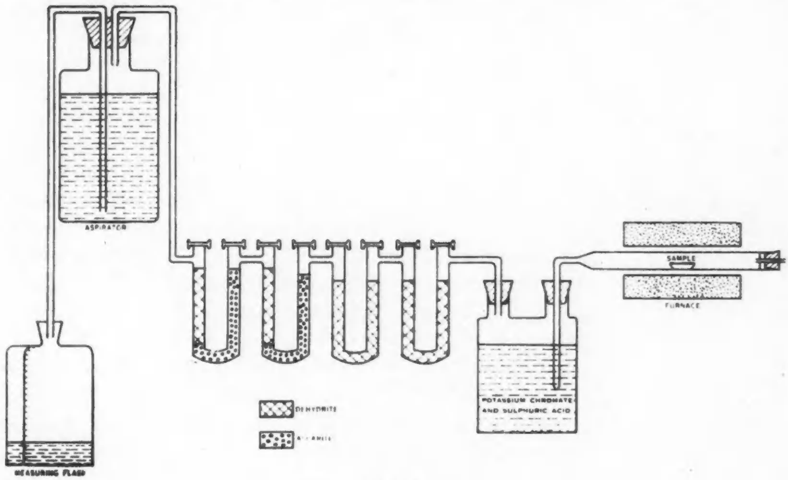


Fig. 1.

seemed unlikely that all the CO_2 was bound in this manner and the purpose of the later tests was to determine whether some CO_2 was merely absorbed, or bound chemically in some other form. To do so the amounts of CO_2 driven off from samples of crushed carbonated mortars at different temperatures was determined, and concurrently the amounts of evaporable and non-evaporable water, so that the relation of these quantities to the degree of carbonation could be studied.

Mortar Specimens.

The mortars examined had a sand-cement ratio of 4 by weight and a water-cement ratio of 0·60 by weight. One brand of cement (conforming to Australian

Standard A2) and one batch of quartz sand of fineness modulus 1·1 were used throughout. Some specimens were vibrated but others were tamped by hand. The air content of the vibrated specimens was about 4 per cent. and that of the tamped specimens was from 8 to 10 per cent.

Three mixtures of mortar were prepared and cubes for compression tests and bars, for measurement of the change of length, were cast. After casting, the specimens were covered and stored in the moulds for twenty-four hours at 21 deg. C. and 100 per cent. relative humidity. After removal from the moulds the specimens were cured by various processes, but generally at 21 deg. C. Specimens were cured in air at relative humidities of 100, 65, or 50 per cent., and in a current of CO_2 flowing at the rate of 1 to 1·5 cu. ft. per hour, and probably therefore having a relative humidity of zero.

Test Procedure.

After periods of curing and exposure of 89, 27, 3 or 2 days, the cubes were tested in compression, and samples were crushed to pass a No. 50 Tyler sieve. An amount of known weight of the crushed material was placed in a porcelain boat and heated in the apparatus shown in *Fig.* 1. Air drawn through the apparatus passed over the sample and then through a bottle containing a solution of potassium dichromate and sulphuric acid saturated with carbon dioxide in equilibrium with the carbon dioxide in air, to remove any sulphur compounds which might be evolved from the heated sample. The air then passed through four U-tubes the first two of which were filled with dehydrite (anhydrous magnesium perchlorate) to remove the moisture, and the other two were filled two-thirds with a sodium-hydrate asbestos absorbent and one-third with dehydrite, to take up the carbon dioxide. The sample of crushed mortar was heated to successively higher temperatures, and the amount of carbon-dioxide driven off at each temperature was determined from the gain in weight of the second pair of U-tubes. The temperature was held at each level until no further gain in weight of the U-tubes could be measured. The quantity of air passing through the apparatus in a given time was determined so that a correction could be applied for the carbon-dioxide content of the air entering the furnace.

Blank tests were carried out to determine the carbon-dioxide content of the air in the laboratory. Other check tests and preliminary tests were made.

Definitions.

Unstable carbon dioxide is defined as that driven off below 500 deg. C.

Stable carbon dioxide is that evolved between 500 deg. and 700 deg. C.

Alkali carbon dioxide is that evolved above 700 deg. C.

Evaporable water is that driven off when the crushed mortar is heated for 2 hours at 108 $\pm$ 1 deg. C.

Non-evaporable water is that represented by the difference between total loss on ignition and the evaporable water plus the total carbon-dioxide content. The carbon-dioxide content of each zone and the water contents are expressed as percentages by weight of the dry cement in the mortar.

Extent of Carbonation.

The maximum total-CO_2 content was 45·40 per cent., the maximum stable-CO_2 content was 28·4 per cent., which implies that, if assumed to be in the form of calcium carbonate, about 54 per cent. of the calcium oxide of the cement has been combined with the CO_2. This amount exceeds the amount of 15 to 20 per cent. of calcium oxide made available as hydroxide as the result of the hydration of the cement, and suggests that the lime compounds in the cement are broken down by the CO_2. The alkali-CO_2 content did not vary greatly for all specimens, the average being 0·77 per cent. compared with the theoretical amount of 0·80 per cent. calculated on the assumption that all the alkali components of the cement are converted to carbonate. The unstable-CO_2 content was from 0 to

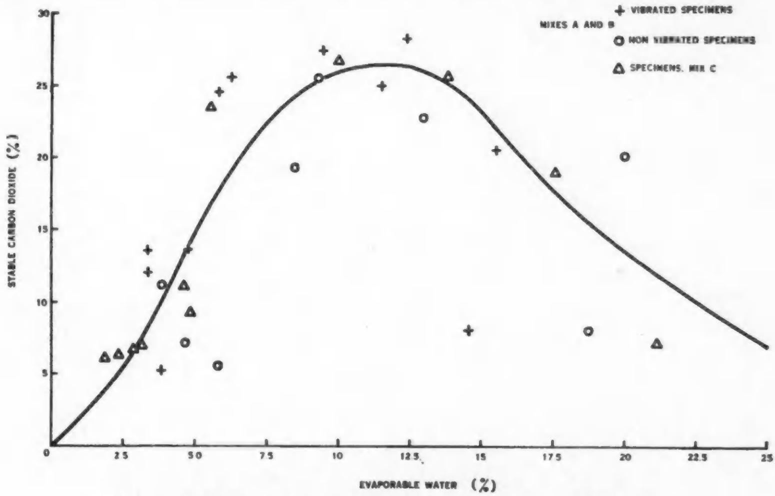


Fig. 2.—Relation between Evaporable Water and Stable CO_2.

21·05 per cent. for one specimen, but in most specimens it was less than the amount of stable CO_2. In the excepted specimen the unstable-CO_2 content was greater and was high even for stable CO_2. The form in which this large amount of CO_2 is held and the reason why this CO_2 is driven off at a lower temperature than when pure calcium carbonate is heated, may be that some of the CO_2 is held as magnesium carbonate (although this would account for only a very small amount), or that some complex mineral (say, scawtite) is formed which decomposes at a low temperature, or iron and aluminium carbonates may be formed if some of the compounds in the cement have been broken down.

It appears that the degree of carbonation was low when the content of evaporable water was very high or very low. The presence of much free water in the voids of the mortar would prevent diffusion of gas through the specimen, and the absence of sufficient water on the surface of the cement matrix might hinder

the reaction with CO_2. An examination was made of the variation of the amounts of stable and unstable CO_2 with the content of evaporable water, but only for the stable CO_2 was there any suggestion of regular behaviour, as is shown in *Fig.* 2, which indicates that the optimum evaporable-water content is about 12·0 per cent.

Compressive Strength.

The compressive strength is compared with the stable-CO_2 content in *Fig.* 3. When the specimens are grouped according to air content there is a fair correlation between the two properties of specimens having an air content exceeding 5 per cent.

A similar correlation obtains between the compressive strength and the total-

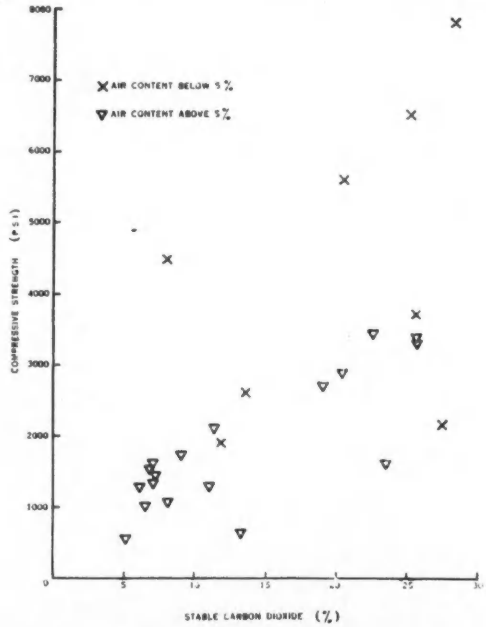


Fig. 3.—Relation between Compressive Strength and Stable CO_2.

CO_2 content—but not the unstable-CO_2 content. Note that in the results in *Fig.* 4, factors other than CO_2 content have been varied.

No such correlation was found between compressive strength and the amount of non-evaporable water, but the effect in this case is probably masked by the evaporable water, which also varied and influenced the strength.

Shrinking and Change of Weight.

Fig. 4 shows the shrinking of test pieces which were first stored at 21 deg. C. and 100 per cent. relative humidity and then dried either at 108 deg. or 256 deg. C.,

and subsequently stored in dry CO_2 at 21 deg. C. or in air at 65 per cent. relative humidity. All evaporable water is removed from specimens dried at 108 deg. C., and the increased loss of weight on drying to 256 deg. C. therefore represents the loss of non-evaporable water, which was about 4 per cent. by weight of cement associated with an increased shrinkage of nearly 0·02 per cent. (0·0002).

The rates of expansion and of increase in weight of specimens stored in CO_2 appear to be independent of the temperature of drying (108 deg. or 256 deg. C.). It is possible that the expansion may be due entirely to the take-up of CO_2. It is not possible to say whether the expansion is due to an increase in the volume of

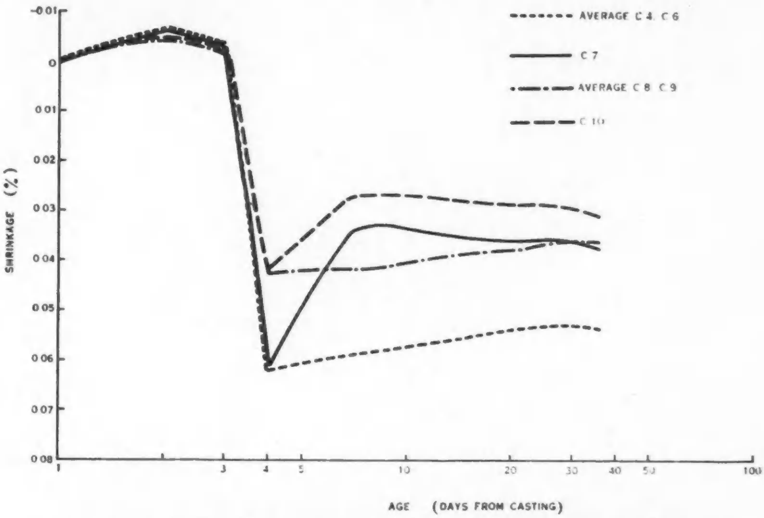


Fig. 4.—Relation between Shrinkage and Age for Tamped Specimens.

calcium oxide or hydroxide converted to carbonate, or the action of water set free by the carbonation of the hydroxide, causing a swelling of the cement gel.

Specimens stored in air at 21 deg. C. and 65 per cent. relative humidity showed a sudden increase in weight after drying and from about 7 days onwards the rate of increase was approximately equal to that of specimens stored in CO_2, which suggests that gain in weight is governed only by the rates of diffusion of CO_2 and water and not by the concentration of these substances in the atmosphere. Although the specimens stored in air expanded during the period of rapid gain in weight, they subsequently shrank slowly. At the end of the test the total-CO_2 content of the specimens stored in air was between 16·05 and 15·90 per cent. and that of specimens stored in CO_2 was between 6·70 and 7·60 per cent. Specimens stored in air contained some unstable CO_2 but the amount in those stored in CO_2 was negligible.

The shrinking of specimens, the storage of which was changed after 27 days,

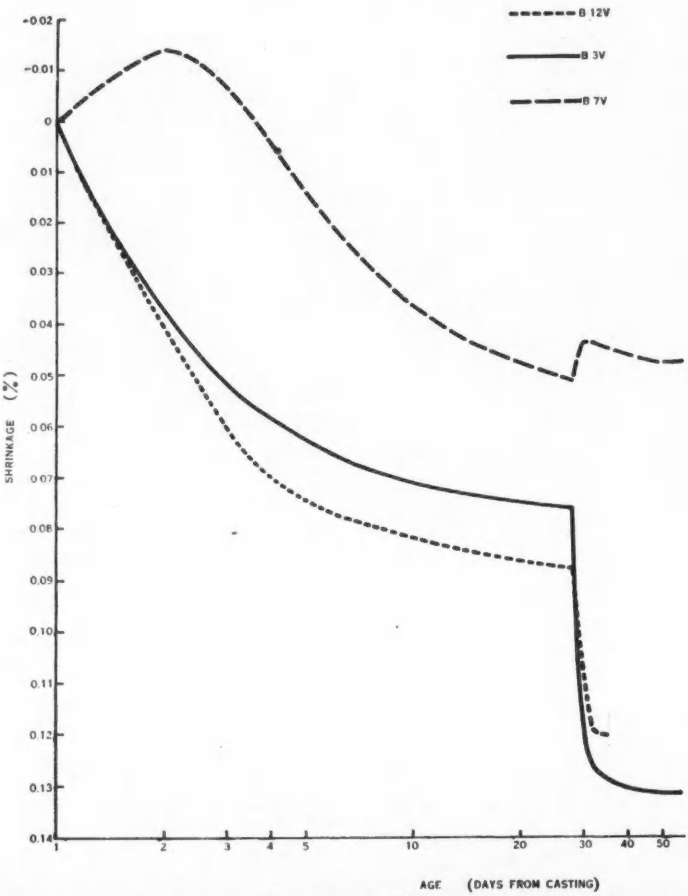
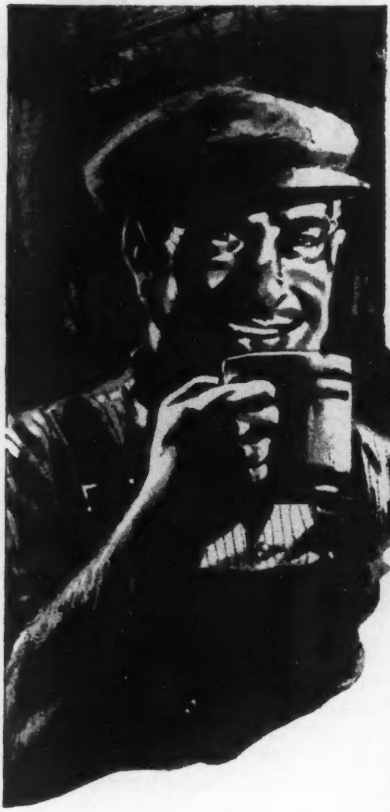


Fig. 5.—Relation between Shrinkage and Age for Vibrated Specimens.

is shown in *Fig.* 5. In each case the second condition of storage produced negligible, or only temporary, fluctuation in weight but the shrinking was observable. Some specimens (B3V and B12V in *Fig.* 5), which passed from air storage at two different humidities to storage in dry CO_2, showed a particularly rapid increase of shrinking, but with only a small temporary increase in weight. As the shrinking started during the period of increased weight, it appears that shrinking may be associated with the absorption of CO_2, but subsequent analyses did not reveal in what form the CO_2 was taken up.

The behaviour of a specimen stored first in dry CO_2 and then in air at 21 deg. C. and 65 per cent. relative humidity resembles that of the specimens described



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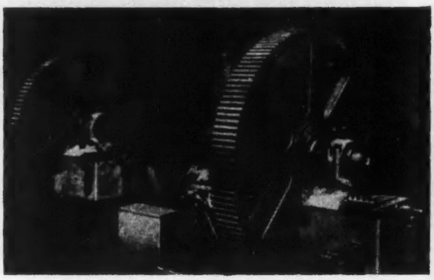


previously, which were oven dried at 108 deg. or 256 deg. C. The CO_2 content of a vibrated specimen stored in dry CO_2 for 27 days at 21 deg. C. is greater than that of a specimen (B7V in *Fig.* 5) which was stored first in CO_2 and then in air at 21 deg. C. and 65 per cent. relative humidity. The water content of the latter specimen was appreciably lower than that of the former. These results are contrary to expectations since some specimens have been stored for a time in the dry so that loss of moisture might be expected, but when some of them are subsequently exposed to a moderate humidity they show a lower moisture content than those which continue to be stored in dry surroundings. The specimens seem to take up more CO_2 from the air at 65 per cent. relative humidity, although the concentration of the CO_2 gas is low, than they do from pure dry CO_2. The expansion shown by specimens in air after drying may be due to absorption of CO_2 rather than moisture.

The results emphasise the importance of water vapour in stimulating absorption of CO_2 and therefore attempts to improve concrete products by storing for a short period in flue gases, where the humidity is probably low, are unlikely to be successful.

Conclusions.

From the results of these and previous tests, the general hypothesis may be that CO_2 may be taken up to a limited extent by dry cement materials and reacts with the alkali constituents and lime compounds to set water free. In the presence of free or evaporable water the absorption of CO_2 increases; some of the CO_2 thus taken up reacts with the lime components of the hydrating cement and forms stable calcium carbonate; some of the CO_2 reacts with the hydration products of the cement and forms unstable compounds. The influence of unstable CO_2 on shrinking may be of the same degree as that caused by evaporable water.

Sampling Solid Fuel.

BRITISH Standard No. 1017 (1960), " The Sampling of Coal and Coke " is issued in two parts. (Obtainable from the British Standards Institution; price 25*s*. for each part.) Part I specifies separate methods of sampling coal not greater than 3 in. in size and of sampling coal in larger pieces. For ease of reference, the recommendations are summarised in an appendix in which also experimental evidence is given. Information regarding methods of assessing the accuracy of the methods is also given. Part II deals with continuous and intermittent sampling of coke.

These standards, which supersede the previous issue of B.S. No. 1017 (1942), do not deal with the analysis of solid fuels; the matter on analysis which was in the previous issue is now given in B.S. No. 1016.

The Cement Industry Abroad.

IN the following are given reports on the production of cement in 1958 and the expansion of the cement industry in various countries during 1959, together with some notes on future extensions.

North America.

U.S.A.—The annual productive capacity of the cement works in the U.S.A. is estimated to have been increased during 1959 by about 2,350,000 tons. Five new works and about sixteen major extensions having a total annual capacity of about 3,000,000 tons were completed in the year. The particulars of some of these plants given in the following are abstracted from reports in various numbers of "Rock Products" and "Pit and Quarry."

The large cement works of the Columbia-Southern Chemical Corporation at Barberton, Ohio, commenced operation recently, and has an annual capacity of 250,000 tons. The works, the operation of which is mainly automatic, comprises a kiln 460 ft. long and 13 ft. diameter.

A kiln 450 ft. long and 11 ft. 6in. diameter and corresponding grinding and auxiliary equipment is being installed at the Clinchfield (Georgia) works of the Penn-Dixie Cement Corporation. The extensions are expected to be completed late in 1960 when the annual capacity of the works will be increased from about 185,000 tons to nearly 400,000 tons.

The installation of a new kiln, having a capacity of 167,000 tons per year, at the works of the Lone Star Cement Corporation at Norfolk, Virginia, will increase the annual capacity of this works to nearly 400,000 tons.

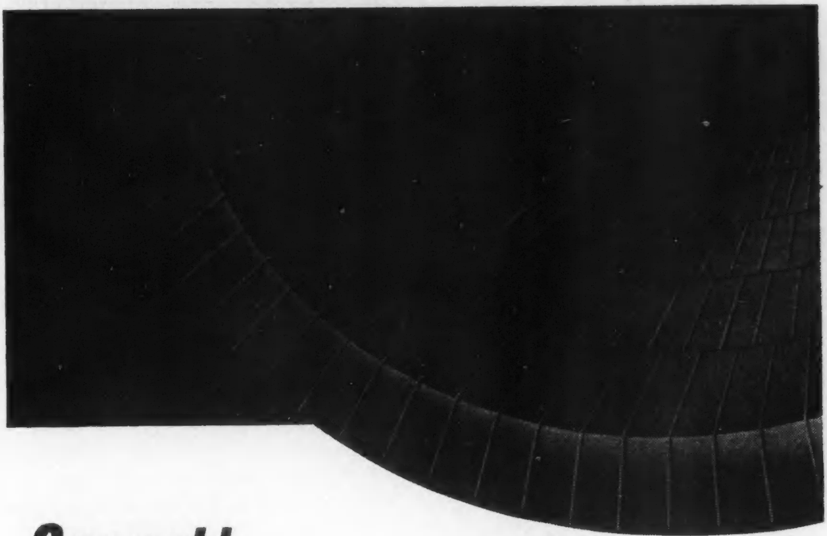
A new grinding mill is being installed in the works of the Huron Portland Cement Co., at Alpena, Michigan. The capacity of the mill will be nearly 1,200 tons per day and will increase the daily capacity of the works to nearly 9,000 tons. Other extensions at these works allow for increased despatching facilities which will be effected by developing and deepening a harbour, and constructing new silos and wharves.

CANADA.—The annual capacity of the cement industry in Canada has increased from nearly 3,000,000 tons in 1950 to 7,000,000 tons at present, it is reported in "Rock Products." A new works having an annual capacity of 667,000 tons has been installed by Messrs. Miron & Freres, Ltd., near Montreal.

Europe.

ITALY.—The Cementir Company opened recently a new works at Arquata Scrivia in north-western Italy; the annual capacity is 500,000 tons. It is announced that it is planned to increase the capacity to 1,000,000 tons, and to increase the capacity of the same company's works at Bagnoli, near Naples, from 800,000 to 1,000,000 tons. (From a report in "Pit and Quarry.")

FRANCE.—The production of cement in France increased by 4·4 per cent. in 1959 compared with 1958, the total amount being 13,750,000 tons. The amount imported was 30,000 tons, and the amount exported (principally to Algeria) was 840,000 tons.



SPAIN.—The production of Portland cement in Spain increased by about 7 per cent. in 1959, compared with 1958 and was about 4,700,000 tons. The production of other types of artificial cements was about 430,000 tons, an increase of about 25 per cent.

Asia.

TURKEY.—Production of cement in Turkey during 1958 was nearly 1,500,000 tons. During the year three new works commenced production. A works at Konya which is to have a capacity of 150,000 tons, is in course of construction. (From a report in " Pit and Quarry.")

SYRIA.—A cement works having a daily capacity of 300 tons is being installed near Aleppo in the Syrian region of the United Arab Republics. The works are being constructed by firms from the German Democratic Republic (East Germany).

JAPAN.—A cement kiln which is claimed to be the largest in the Far East has been ordered by the Tokuyama Soda Co., from the Mitsubishi Shipbuilding & Engineering Co., of Tokyo. The kiln will have a capacity of 1500 tons per day.

The Chichibu Cement Co., near Tokyo, has purchased an Allis-Chalmers cement plant, which will be manufactured by Kobe Steel Works, the licensees of Allis-Chalmers, Ltd., in Japan. The plant is designed to produce about 700 tons of Portland cement per day. In the past five years, according to a report in " Pit and Quarry," eleven such plants have been installed in the Far East, namely. four in Formosa, three in the Philippines, and four in Japan.

A New Pump for Pulverised Materials.

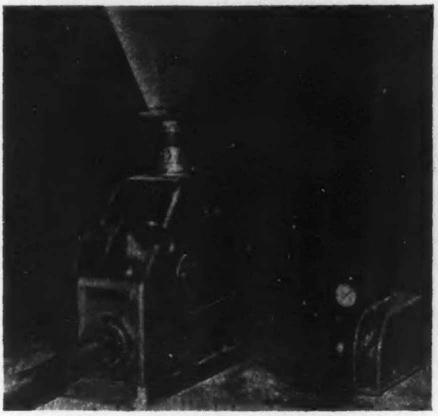


Fig. 1.

A NEW pump for the transfer of pulverised materials is illustrated in *Fig.* 1. The pump conveys, at rates up to 8000 lb. per hour, most powdered materials

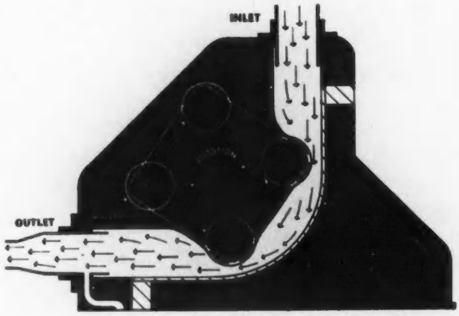


Fig. 2.

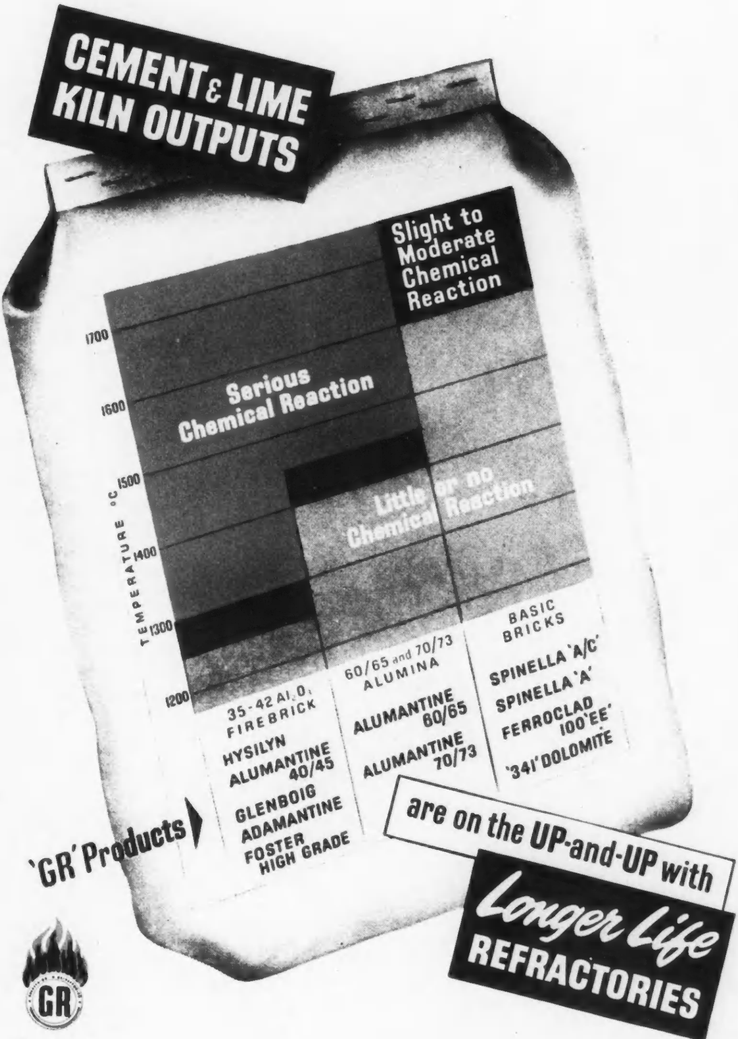
that can be fluidised by air, including cement, whiting, plaster of Paris, chalk and kaolin. Vertical lifts up to 70 ft. combined with total conveying distances of 200 ft. are said to be achieved under ordinary working conditions. The pump (*Fig.* 2) comprises an open flexible tube, a rotor with four rollers placed equidistantly, and an inlet for compressed air. The action of the rotor progressively squeezes the materials through the flexible tube, compressing and releasing the tube in turn, thereby thrusting the material through in a continuous stream. Only at this stage is the air brought in contact with the material. The air, being unable to leak back through the pump because of the pressure of the rollers, is used solely for conveying the material. In a normal installation about 15 to 20 cu. ft. of air per minute is required. An elaborate dust-collection apparatus is unnecessary, since a simple filter-sock is sufficient. In the event of the supply of material being interrupted the pump can run dry without sustaining damage.

The pump, which is called the Squeegee and is made by Messrs. Henry Simon, Ltd., is of two sizes, namely, 3 in. and 2 in., and is driven by a 1-h.p. motor.

Book Received.

"Elementi di Chimica del Cemento." (Elements of the Chemistry of Cement.) By Prof. Luigi Santarelli. (Milan: Libreria Editrice Politecnica Tamburini. 1960. 200 pages. Price 2,000 l.)

THIS volume is intended to be the text book on the chemistry of cement included in the course on reinforced concrete at Milan Polytechnic and deals with most of the aspects of the subject which should be included in such a course. There is a well-illustrated chapter on the manufacture of Portland cement.



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